Mechanistic modeling for predicting the effects of restoration, invasion and pollution on benthic invertebrate communities in rivers (Paillex et al. 2017) [1]

Habitat destruction, biological invasions and water quality deterioration are serious threats to native communities and can lead to modifications in community composition and structure, and in ecosystem function. To predict the consequences of river restoration, biological invasions and water quality change in the taxonomic composition of macroinvertebrate communities in rivers, we extended the mechanistic model Streambugs, which describes growth, respiration and death of interacting taxa under given environmental conditions.

The model parameterised with prior knowledge on macroinvertebrate traits had already a reasonable explanatory power for data from restored and unrestored sites in two Swiss rivers. As anticipated, the explanatory power of the model was increased further by incorporation of learning from observations through Bayesian inference. The predictive application of the model to changes in water quality and invasions by alien species indicated the importance of integrative planning of management measures: although invasive species are predicted to be able to colonise restored and unrestored sites and replace native species, both invasion of alien species and subsequent exclusion of native taxa is predicted to be reduced when water quality improves.

The unavoidable simplification in the mathematical description of complex interactions in the macroinvertebrate community results in predictions that are uncertain. Our modelling techniques make the best attempt to quantify this uncertainty. Despite the uncertainty that always calls for more research, this study makes a considerable step towards improving our understanding of community structure and supporting river management through mechanistic, predictive modelling of macroinvertebrate communities in rivers under changing environmental conditions.

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https://doi.org/10.1111/fwb.12927 [2]

Links

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[1] https://reformrivers.eu/mechanistic-modeling-predicting-effects-restoration-invasion-and-pollution-benthic-invertebrate
[2] https://doi.org/10.1111/fwb.12927

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